AMENDMENTS TO THE CLAIMS

Claims 1-57 (Cancelled).

58. (New) A converging element which converges a light beam from a light source onto each of at least two types of optical information recording media of thickness different between them and made of a transparent plate, said converging element having an inner region near a center axis of the light beam and an outer region far from the center axis, said outer region having a plane optimized to converge the light beam transmitting said outer region onto a first optical information recording medium among the optical information recording media, said inner region having a plane optimized converge the light beam transmitting said inner region onto another optical information recording medium having a larger thickness than the first one, wherein a phase of the light beam transmitting an innermost portion in the plane of said outer region is shifted relative to that of the light beam transmitting an outermost portion in the plane of said inner region,

wherein said element comprises a lens which converges the light beam from the light source onto an optical information recording medium and an optical plate element to be cooperated therewith;

wherein said lens comprises a first inner subregion near a center axis of the light beam and a first outer subregion far from the center axis, said first outer subregion far having a plane optimized to converge the light beam transmitting said first outer subregion onto the first optical information recording medium, said first inner subregion

having a plane optimized to converge the light beam transmitting said first inner subregion onto the another optical information recording medium having a larger thickness than the first optical information recording medium;

wherein said optical plate element comprises a second inner subregion and a second outer subregion divided from the second inner subregion with an optical step;

wherein said second inner subregion and said outer subregion are arranged such that the light beam transmitting said first outer subregion transmits said second outer subregion while the light beam transmitting said first inner subregion transmits said second inner subregion;

wherein said inner region comprises said first inner subregion and said second inner subregion, and said outer region comprises said first outer subregion and said second outer subregion.

59.(New) The converging element according to claim 58, wherein said second inner subregion of said optical plate element is made of a dielectric material different from that of said second outer subregion.

60.(New) The converging element according to claim 58, wherein thickness of said second inner subregion of said optical plate element is different from that of said second outer subregion thereof.

61. (New) The converging element according to claim 60, wherein the thickness of said second inner subregion is constant.

62.(New) The converging element according to claim 60, wherein said second inner subregion has a plane optimized to converge the light beam transmitting therethrough.

63.(New) An optical head comprising:

a light source for generating a light beam;

a converging element which converges a light beam from said light source onto each of at least two types of optical information recording media of thickness different between them and made of a transparent plate, said converging element having an inner region near a center axis of the light beam and an outer region far from the center axis, said outer region having a plane optimized to converge the light beam transmitting said outer region onto a first optical information recording medium among the optical information recording media, said inner region having a plane optimized converge the light beam transmitting said inner region onto another optical information recording medium having a larger thickness than the first one, wherein a phase of the light beam transmitting an innermost portion in the plane of said outer region is shifted relative to that of the light beam transmitting an outermost portion in the plane of said inner region,

wherein said element comprises a lens which converges the light beam from the light source onto an optical information recording medium and an optical plate element to be cooperated therewith;

wherein said lens comprises an inner region near a center axis of the light beam and an outer region far from the center axis, said outer region having the plane optimized to converge the light beam transmitting said outer region onto the first optical information recording medium, said inner region having the plane optimized to converge the light beam transmitting said inner region onto the another optical information recording medium having a larger thickness than the first one;

wherein said optical plate element comprises an inner portion and an outer portion divided from the inner portion with an optical step, said inner and outer portions are arranged in cooperation with said lens such that the light beam transmitting said outer region of said lens transmits said outer portion and the light beam transmitting said inner region of said lens transmits said inner portion.

64.(New) The optical head according to claim 63, wherein said light source generates light beams of two wavelengths, and said lens has a plane in said outer region optimized to converge the light beam of a first wavelength in the two wavelengths transmitting said outer region onto the first optical information recording medium and has another plane in said inner region optimized to converge the light beam of a second wavelength different from the first one transmitting said inner region onto the another

optical information recording medium having a larger thickness than the first one when said lens is cooperated with said optical plate element.

65.(New) The optical head according to claim 63, wherein said optical plate element and said lens are held by a movable member having a driver means which moves it in focus and tracking directions for said lens, and said optical plate element and said lens are arranged to keep dynamical balance relative to a center of gravity of said movable member.

66.(New) The optical head according to claim 64, wherein said optical plate element and said lens are held by a movable member having a driver means which moves it in focus and tracking directions for said lens, and said optical plate element and said lens are arranged to keep dynamical balance relative to a center of gravity of said movable member.

67.(New) The optical head according to claim 66, wherein said light source generates light beams of two wavelengths, and said lens has the plane in said inner region optimized to converge the light beam of a second wavelength different from a first one generated by said light source and transmitting said inner region onto the another optical information recording medium having a larger thickness than the first one.

68.(New) An optical information recording and reproducing apparatus comprising:

a light source which generates a light beam;

a converging element which converges a light beam from said light source onto each of at least two types of optical information recording media of different thicknesses and made of a transparent plate;

a photodetector which receives a light reflected from the each of the optical information recording media to convert it to an electric signal; and

a signal processor which distinguishes the type of optical information recording medium and reads information selectively from the electric signal;

wherein said converging element comprises an inner region near a center axis of the light beam and an outer region far from the center axis, said outer region having a plane optimized to converge the light beam transmitting said outer region onto a first optical information recording medium among the optical information recording media, said inner region having a plane optimized to converge the light beam transmitting said inner region onto another optical information recording medium having a larger thickness than the first one, and a phase of the light beam transmitting an innermost portion in the plane of said outer region is shifted relative to that of the light beam transmitting an outermost portion of the plane of said inner region,

wherein said element comprises a lens which converges the light beam .from the light source onto an optical information recording medium and an optical plate element to be cooperated therewith;

wherein said lens comprises a first inner portion near a center axis of the light beam and a first outer portion far from the center axis, said first outer portion having a plane optimized to converge the light beam transmitting said first outer portion onto the first optical information recording medium, said first inner portion having a plane optimized to converge the light beam transmitting said first inner portion onto the another optical information recording medium having a larger thickness than the first one;

wherein said optical plate element comprises a second inner portion and a second outer portion divided from the second inner portion with an optical step, said second inner and outer portions are arranged such that the light beam transmitting said first outer portion transmits said second outer portion while the light beam transmitting said first inner portion transmits said second inner portion when said optical plate element is cooperated with said lens.

69.(New) The apparatus according to claim 68, wherein said optical plate element and said lens are held by a movable member having a driver means which moves it in focus and tracking. directions for said lens, and said optical plate element and said lens are arranged to keep dynamical balance relative to a center of gravity of said movable member.

70. The apparatus according to claim 68, wherein when the light beam is converged onto the first optical information recording medium, and wave-front aberration satisfies the condition that

total amount of aberration $\geq$ 20 mλ (rms),

and

fifth spherical aberration $\leq$ 20 mλ (rms).

71. The apparatus according to claim 70, wherein when the light beam is converged onto the first optical information recording medium, and wave-front aberration satisfies that the condition that

seventh spherical aberration $\leq$ 30 mλ (rms).

72. The apparatus according to claim 68, wherein numerical aperture, NA, of the plane of said inner region and NA of the entire aperture has a following relationship that

0.7 * NA of entire aperture $\leq$ NA of inner region $\leq$ 0.8 * NA of entire aperture,

and phase shift of the light beam transmitting the innermost portion of the plane of said outer region to that of the light beam transmitting the outermost portion of the plane of said inner region has a value between 50 and 150 degrees.

73. The apparatus according to claim 68, wherein said converging element is optimized to converge the light beam onto an information recording medium having a

thickness of the inner region equal to or smaller than t1*0.6 wherein t1 denotes thickness of a plane of a second information recording medium among the optical information recording media.

74. The apparatus according to claim 68, wherein said photodetector is provided for each of the optical recording information media of different thicknesses.